The JOHNSON NATIONAL DRILLERS JOURNAL

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REASONS WHY SOME WELLS ARE DISAPPOINTMENTS

Purposes of Test Drilling

The discussion of test-hole drilling in the first of this series of articles pointed out the importance of test holes or test wells and described the methods commonly used for doing this work. Four or five fundamental purposes of test-hole drilling were outlined. It will be helpful to review some of these purposes briefly before going on to discuss some actual cases of test drilling where mistakes were made that led to disappointments because the wells designed on the basis of the tests did not turn out to be as good as was expected.

Formation Samples

Getting true samples of the water-bearing sands and gravels that are penetrated by the test hole is one of the main reasons for the test drilling. Samples that are good enough to identify other strata are also needed. But a sample of water-bearing sands and gravel must be as true as possible and it ought to contain all the material that is a part of the formation at the depth where the sample is taken. This means getting a sample that contains the gravel, the coarse sand, the fine sand, the silt and the clay from the formation and in the same proportions that these materials exist in the stratum represented by the samples. The method used to take the sample must be aimed at doing just this.

Logging

A good log of all the layers or strata penetrated by the test hole is a second important purpose. Dry sand layers, hard and soft clay layers, boulder nests, and shale or rock ledges may all have some bearing on the design of the well that is to be drilled. The depth to the top and bottom of each layer should be determined and recorded. Samples plus the "feel" of how the material drills, or the way it affects the operation of the drilling machine, tell an experienced driller what kind of formation the bit is working in. Each formation should be clearly described in the log.

A 10-inch Johnson Everdur Screen being lowered in well near Caracas, Venezuela, by a crew of the important Venezuelan drilling firm, S. A. Geotecnica.

Where several test holes are drilled in a given area, the logs are studied together to try to get a mental picture of the way the various formations run and to get an idea of the extent of each. Logs that are accurate in detail, clearly describing each stratum, make it possible to build up this picture.

Water Level

A third aim of test drilling is to get the depth to water. If more than one water-bearing formation is found, the water level may be different for each of them. Methods of determining the ground-water level for each formation must be worked out.

This almost always means casing the hole to prevent any influence on the water level by leakage to or from the overlying strata. If drilling mud is being used, special steps must be taken to remove the mud from the hole to let the water seek its level, since the mud seals both the sides and the bottom of the hole.

Water Samples

The quality of water is often different at different depths; so another reason for test drilling may be to get water samples. Samples are taken by pumping or bailing water from each formation with all the other formations shut off by casing or other means. Pumping or bailing should be continued long enough to be sure to remove any contamination from the drilling operations before taking the water sample for laboratory analysis. Along the Eastern Coast, the deeper sands often contain softer water than the water in the glacial sands and gravels and the deeper

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water is, therefore, more valuable for many uses. In some areas of the Middle West, the water just above the granite in glacial sands and gravels often contains more iron and is thus less desirable than the water in the same glacial material at less depth.

Check on Geology

General geological ideas are often worked out for a given area from the stream pattern, the surface soil materials, the rock outcrops, and the contour of the ground. Logs and samples from test holes are of great value as a check on these geological deductions and as an aid to the geologist in developing more detail and accuracy in his picture of how the formations came to be and what connection their geological history may have with their water-bearing features.

Comparing Well Sites

Comparison of samples of sand or gravel strata from two or more test holes and comparison of the entire logs of the test holes permit one to select the best site for a well and discard the poorer ones. To be of any real value for this purpose, the samples and logs must be true and must represent the actual conditions. If they are not, the wrong site will be picked and the well at that location is likely to be a disappointment.

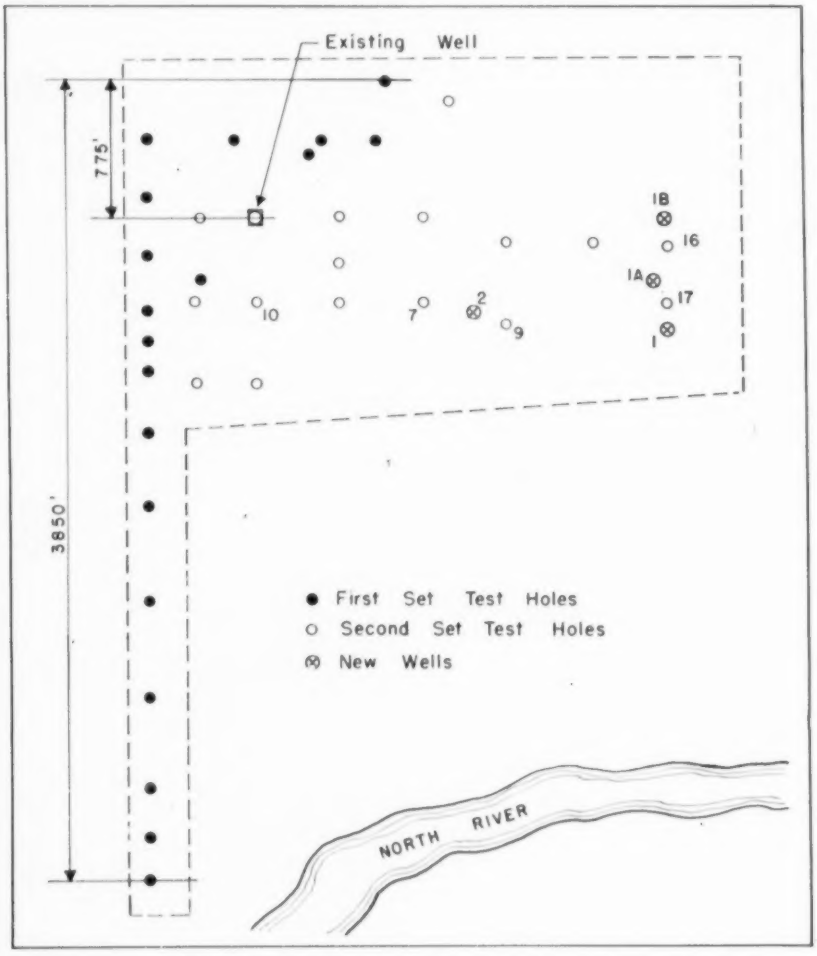

Figure 1. Municipal well field showing locations of test holes and well sites.

Municipal Well Field

The following story shows what can happen when samples from test holes do not truly represent the water-bearing sand. It is a good case history to study because plenty of test holes were drilled, good drilling equipment was used, and samples were easily obtained; but two different drillers made the same small mistake that led to a disappointing result.

Figure 1 shows the general layout of the land bought by a certain town for a well field. A series of twenty test holes was first drilled as shown by the solid circles. This test drilling showed that the depth to shale or rock was about 30 feet at most places. Layers of water-bearing sand were encountered in each test hole, and these were identified as "fine sand" and "coarse sand" by the driller. Apparently, the contractor doing this group of test holes had a preconceived notion that the only thing he needed to look for was a spot where the material which he was calling "coarse sand" was the thickest. In any case, the recorded data from these test holes was simply a table showing the thickness of "coarse sand" found in each hole. There was no record of the total thickness of the water-bearing sand, both fine and coarse, and no description of whether or not the sands were clean or dirty. Presumably all the samples were considered to be clean sand. The samples were not tested, but were classified by simply looking at them.

A well was put in at the site marked "Existing Well" which produced about 10 gallons per minute per foot of drawdown and a total yield of about 120 gpm. The town used this well for a few years and then decided to put in two more wells in this general area to provide a greater supply to meet its increased water demand.

Another series of test holes was then drilled to find the best locations for the two proposed wells. The seventeen open circles in Figure 1 show the locations of these tests. The drilling contractor who did this work kept complete logs of each hole and took samples of

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each stratum of water-bearing sand that he found. The depth to rock varied from 29 feet to 48 feet in these holes. As luck would have it, the log of the deepest hole was not too favorable because there were 12 feet of blue clay just above the rock. Logs of three test holes that are typical of most of them are shown in Figure 2.

The static water levels in the test holes varied from three to six feet, which was due to differences in elevation of the ground surface at the test-hole locations. The water table was practically level. This well field is on the flood plain of a stream and the water table goes up and down with the changes in the seasons, being highest in the Spring which was the time of year when these readings were taken. In the Fall of the same year, the water table was generally about three feet lower.

The driller who did the test holes sent all the samples of water-bearing sand to the laboratory for analysis. The samples ranged from fine to coarse, as the typical logs show. The finest sample was from test hole No. 1, and a No. 25 slot well screen would have been required at that site. The coarsest samples were from test holes No. 10 and 11, where No. 80 slot screens could have been used in the coarse strata.

All the samples sent to the laboratory consisted of clean sand, except the sample representing the material from 18 to 23 feet in test hole No. 6 which was a mixture of sand and clay. There was no evidence of clay or silt in any of the other samples. The indications from these samples were that any of several sites could be picked for the two new wells to be drilled.

The town engaged an excellent firm of consulting engineers to prepare specifications for the wells, for the necessary pipeline to connect the wells to the water system and for several other improvements to the municipal waterworks. Based on the test-hole logs and the analyses of the sand samples, the engineers selected a site near test hole No. 17 and a site between test holes No. 7 and 9 for the new 16-inch wells to be drilled. These locations are shown as No. 1 and No. 2 in Figure 1.

Pumping Test

The engineers also made a pumping test of the existing well in order to determine the average hydraulic properties of the whole well field and the surrounding area. The test was made to get a measure of the average yielding ability of the water-bearing sand of the whole aquifer. A further aim of the pumping test was to try to estimate whether or not this area would support two more wells of the same yield as the existing well without causing too much lowering of the water table.

Drawdown readings during the pumping test were taken in five observation holes put in at various distances from the existing well.

Analysis of the pumping test data showed that the yielding ability of the aquifer is such that two new 16-inch wells could be expected to produce at the rate of 10 gallons per minute per foot of drawdown, and that there would be little or no danger of any permanent lowering of the water table.

An important point to note here is that, when drawing conclusions from a pumping test such as this one, it should be clearly understood that the yielding ability of the formation that is measured by the test is the **average** yielding ability of the aquifer over a considerable area. It is not the yielding ability at any one or more local spots, but is the **average** over the area influenced by the pumping well. It is important to remember this fact because the water-bearing sand varies from place to place but the average of all these variations is what affects the drawdown readings during the pumping test. Even though the test shows a high **average** yielding ability, there are often some "bad spots" in the aquifer; and if a well is located at one of these spots it will not be as good a well as the calculations from the pumping test indicate

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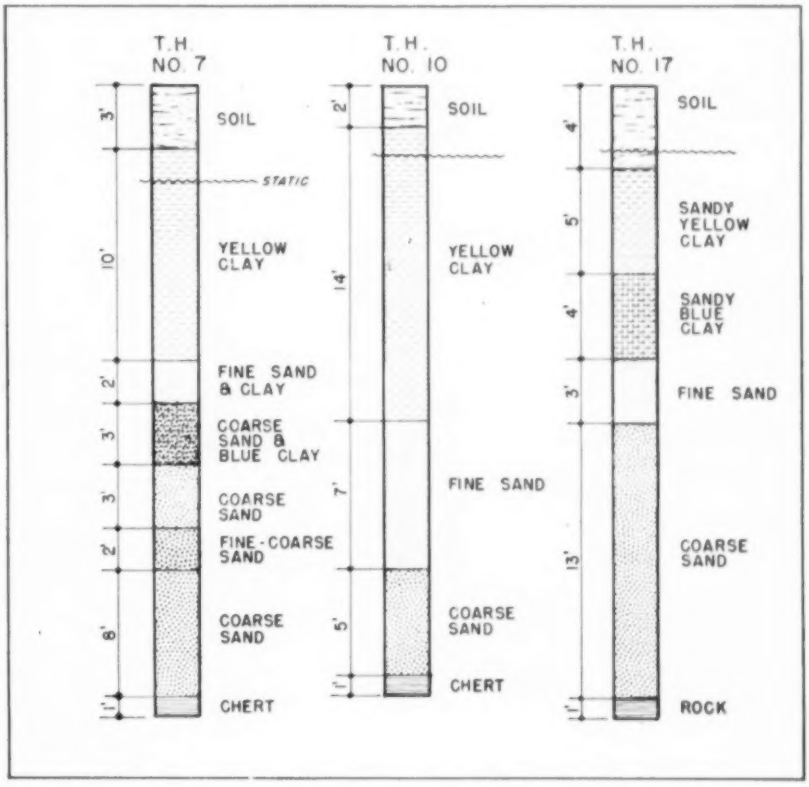

Figure 2. Representative logs of three test holes of the second series.

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that it ought to be. This means that a test hole is necessary to determine the conditions at a proposed well site in spite of the fact that other information shows the situation to be generally favorable.

New Well Construction

A contract was let for two 16-inch, natural-developed wells. The drilling contractor moved in and put down 16-inch casing at site No. 1 near test hole No. 17. Samples of the water-bearing sand were taken from 16 feet to 29½ feet and sent to the laboratory for analysis. The static water level was eight feet below ground surface. The samples as received at the laboratory consisted of coarse sand with some fine gravel. There was no evidence of any clay or silt in them.

A 12-foot Everdur screen was made up, with slot openings selected according to the grading of the sand samples. The screen was installed and the well was developed by surging. The quantity of sand removed by the development work was less than normal. There was some evidence that the formation was a little "tight" but not much attention was given to this. When the well was sand-free, it was test pumped.

The results of the test pumping were disappointing, to say the least. The yield was 53 gallons per minute at a drawdown of 11.3 feet, or 4.7 gpm per foot of drawdown. This was less than half of the expected yield.

The consulting engineer, drilling contractor and screen manufacturer conferred to try to find a reason for the results. They carefully reviewed the laboratory tests of samples and the details of construction. No explanation came out of this so the screen manufacturer suggested that some observation holes be put in and that a short pumping test be made to compare with the previous test using the existing well. This was done. Figure 3 shows well No. 1 with the relative locations of four of the observation holes. A fifth one, not shown, was located 275 feet from the well. Drawdown readings were taken in all of these while pumping the well.

These data were analyzed after the test. They showed about the same results as did the first pumping test for the average yielding ability of the formation, but the drawdown readings in the pumped well and in the observation hole five feet away were much too great in comparison to the others. A study of this led the screen manufacturer to suggest that the well was in a "bad spot" in the formation. It looked as though the formation in the vicinity of the well was clogged with something.

It was then decided to pull the screen and casing, and to put down a second hole 30 feet away at the location shown as No. 1A in Figure 1. The driller took steps to get the best possible samples as he sank the 16-inch casing the second time.

The following is a log of hole No. 1A:

Topsoil & clay	0'- 7'
Fine sand	7'-15'
Medium sand, dirty	15'-24'
Coarse sand, dirty	24'-30'
Sand and gravel	30'-32'

The samples were laid out for inspection before deciding whether or not to put the screen in this well because the formation was dirty. Everyone was on the lookout for something to account for the poor showing at the first site. All the samples at this second site from 15' to 30' contained much silt and clay, and it was obvious from the samples that there was not a chance of getting a good well at this location.

In discussing these samples, the driller said that they were about the same appearance as the samples from site No. 1. This was news, for the samples tested were clean. However, he had not thought the silt and clay in the first set of samples to be serious so he had washed the dirty material out before taking the samples to the laboratory for testing. The fact that the dirty sand was found in drilling both the 16-inch holes tied in with the indications of the pumping test and proved that this part of the well field in the vicinity of test hole No. 17 was a bad spot. There was no doubt but that the formation here was loaded with clay and silt.

This might have been known ahead of time if the samples that were analyzed from test hole No. 17 had been truly representative of the formation. In such a case, the engineers would not have selected this spot as a site for one of

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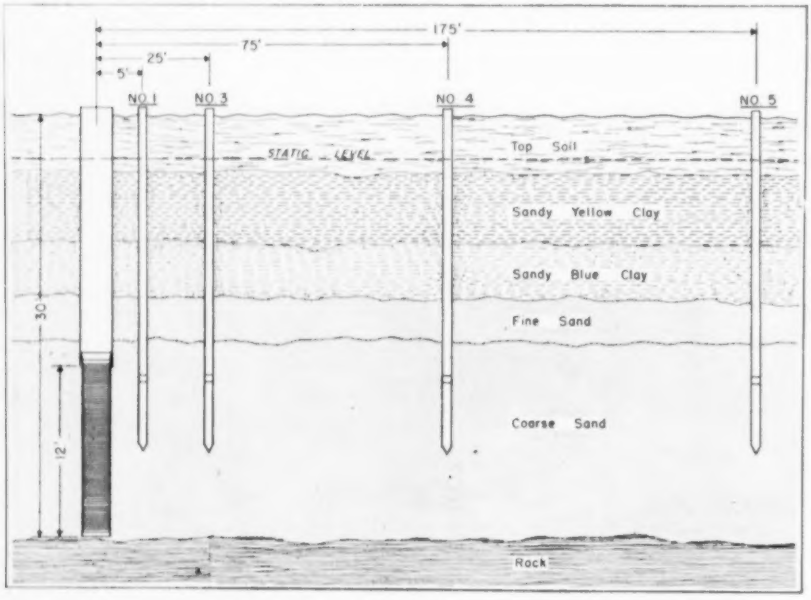

Figure 3. Well at site No. 1 and observation holes used during pumping test.

the permanent wells. There is no way of knowing what may have happened to the samples from test hole No. 17 but it is certain that they did not contain the clay and silt that is present in the water-bearing sand. Apparently they were subjected to some sort of washing action during the sampling operation, or the mistake was made of washing the clay and silt out of them when preparing them to be sent to the laboratory. The lesson here is obvious. Samples that are not representative of the water-bearing formation can easily be the basis for errors in well location and design. The trouble may result either from improper sampling methods or from improper handling of the material that the bailer brings up.

Finding a Suitable Well Site

Discovery of the clay and silt in the formation led to pulling the 16-inch casing from site No. 1A and to finding another site where it could be expected that the sand would be clean. It so happened that the driller had made up a hand pump from an old pump cylinder which he had used to pump out the drive-point wells used as observation holes to be sure that they were not clogged. In cleaning out these wells, he noticed that the one located 275 feet north of original site No. 1 pumped more freely than the others. He could break suction in each of the four drive-point wells shown in Figure 3 when pumping at a rate of about four gallons per minute. However, he could not break suction in the fifth small well when pumping it at six to seven gallons per minute, which was the capacity of his hand pump.

Based on this simple information, it was decided to put the 16-inch casing down at the location of the best drive-point well. This was then designated as site No. 1B, and from Figure 1 it can be seen to be near test hole No. 16.

The samples from the 16-inch hole at site No. 1B showed fairly clean coarse sand from 20 feet to 29 feet, and fine sand with some clay from 29 feet to 32 feet. The 12-foot screen that had been made up for site No. 1 was installed here and the well was developed with a valve-type surge plunger. Water was pumped from the well with a centrifugal pump during part of the surging operation to help remove any silt or clay brought in by the development work. When sand-free, the well was pumped at 100 gallons per minute for 24 hours, at the end of which time the drawdown was 12.3 feet. The specific capacity was, therefore, 8.1 gpm per foot of drawdown which means that it was almost twice as good a well as at site No. 1. It was not quite up to the 10 gpm per foot of drawdown that had been expected, but the engineers considered the result to be satisfactory.

The success of the idea of hand-pumping the drive-point wells to choose this well location led the engineers to ask the driller to do the same thing in the general area of the proposed site for well No. 2. As the result, well No. 2 was actually drilled between test holes 8 and 9 and a little to the east, in

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Figure 4. Typical glacial sand and gravel showing how material is stratified. One must keep a picture like this in mind to work out methods of getting samples that represent the formation.

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place of the location originally chosen as shown in Figure 1.

Well No. 2 turned out to be 35 feet deep which means that the rock is 3 to 4 feet deeper here than at the extreme east end of the well field. The water-bearing formation consisted of coarse sand from 17 feet to 30 feet and fine sand from 30 feet to 35 feet. All of the samples showed a clean formation except for a trace of clay in the stratum from 17 feet to 20 feet. A 14-foot Everdur screen was set in this 16-inch well. Development was done by using a valve-type surge plunger and slow pumping. Upon completion, well No. 2 was test pumped at 140 gallons per minute with a drawdown of 13.8 feet, or a specific capacity of 10.1 gpm per foot of drawdown. The cleaner sand and greater thickness of formation at this site easily account for the better results here as compared to the results from well No. 1B.

The story of this job has been told in much detail because it teaches

THREE IMPORTANT LESSONS

1. Pumping tests and test holes, both properly done, give maximum information about an aquifer when studied together.

2. In a generally good aquifer, there are often (perhaps always) local bad spots that must be avoided in choosing well sites.

3. Methods of sampling and handling samples of water-bearing sand must be such that all the material of the formation will be included in the samples.

A 12-inch Johnson Everdur Screen 25 feet long being put in by Saltzgaber Drilling Co. of Mansfield, Ohio, in a well for Fredericktown Sand & Gravel Co. Well was developed 12 hours with surge and air lift. Test pumped at 2000 gpm with 13 feet drawdown.

"He's left-handed and keeps his change in his right-hand pocket," mentions Cutie Cathead in telling about her boy friend.

——o——

Accompanist — "Madam, I've played on the white keys and I've played on the black keys, but why must you always sing in the cracks?"

——o——

"He seems to have a very good opinion of himself."

"Yes. On his last birthday he sent his parents a telegram of congratulation."

——o——

Bob Hope—"I understand you have your own radio program now."

Herbert Marshall—"Yes, I am "The Man Called X."

Bob—"Oh yes, I met your wife, Virus."

——o——

Little girl (on a transcontinental train)—"Mama, what's the name of the last station we stopped at?"

Mother — "Don't bother me. Can't you see I'm reading? Why do you ask?"

Little girl — "Because brother got off there."—Pictorial Review.

——o——

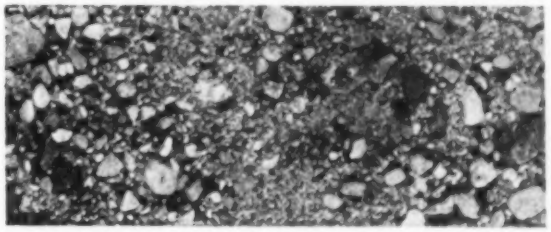
Wife (trying on hats)—"Do you like this one turned down?"

Hubby—"How much does it cost?"

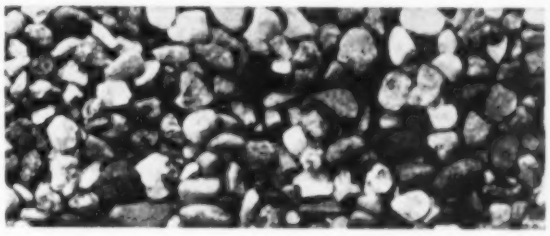
Wife—"Twenty dollars."

Hubby—"Turn it down."

BETTER WELL DEVELOPMENT



Well screen was set in this natural formation of coarse sand.



Coarse particles left around well screen after completing "development" work.

A matter of thirty years or so ago, a trend was quite definitely establishing itself in the finishing of water wells in sand and mixed sand and gravel formations. This was the trend **away from** what may be termed the "strainer" principle of well completion **to** the "screen" principle. In the former, the fundamental idea was that of a strainer or filter placed in the water-bearing formation for the purpose of holding out virtually all the sand. In the latter, the idea was that of a selective screen which purposely permitted a considerable proportion of the surrounding sand to pass through its openings into the well, from which it was removed by various means. (This is not to be confused with the method of well construction in which the attempt is made—with widely varying degrees of success—to cause an actual cavity to be formed around the well-end by the bridging action of the water-bearing formation. Such wells are not stable wells but are usually persistent or intermittent sand-pumpers.)

In selecting a well screen for use in the "strainer" type of construction, it was common practice to use a size of screen opening which would permit only about 10% or 15% of the sand to pass. An examination of old records will show that daring to choose a screen opening of a size that would pass 25% of the sand sample was considered risky business, and many wells finished with such screens were condemned as failures because they were thought of as sand-pumpers. Although they usually cleared up after some time and became good wells, they were frowned upon because they required cleaning out, they were hard on pumping equipment, and they put sand into the water system.

Gradually, as well drillers and engineers gave the matter careful study and did a great deal of intelligent experimenting, the idea of purposely permitting more sand to pass into the screen, and then removing it by various means, became more widely accepted and the well-finishing procedure known as "development" came into its own.

"Development" meant simply using some effective means to move the finer portion of the sand out of the formation surrounding the well screen, through the screen openings, and out of the well. Many devices and methods were used to accomplish this result. The earliest, and usually least effective, were simply heavy bailing and "over-pumping," that is, pumping the well at a rate beyond the intended permanent rate. Compressed air was used with much success in many cases, operating the air-lift pump in quick and violent surges alternated with steady pumping. "Surge blocks" or "surge plungers" of various kinds found wide acceptance as inexpensive and effective devices.

Along with the growing acceptance of "development" there was, rather naturally, an increasing boldness in the selection of the sizes of screen openings. An examination of sand analysis records will show that some dared to use openings large enough to permit as much as 85% to 90% of the sand to pass through the screen. This was, of course, a complete reversal in thinking. As might be expected, many of these extreme selections resulted in failures—but many others did turn out to be successful.

By constant comparison of results in many thousands of wells, under a wide range of conditions, the experienced well driller and the trained analyst in the laboratory are now able to work together to select the screen openings which will give maximum results from modern development methods without the risks of failure from caving, persistent sand-pumping, etc., which were rather common occurrences some years ago. The driller must be able to log his well and take the samples accurately, and then apply proper development methods. The analyst must be able to interpret the log and the samples intelligently so that the screen openings will be of proper size to make it possible for the driller to develop the well effectively and safely to its ultimate capacity.

Probably the easiest way to visualize what happens when a well is properly developed is to think of the sand and gravel formation around the well-end as a system of pipe lines all leading finally to a single control pipe. If the well is not developed at all these pipes are all of the same size. This would be much the same as setting up a pipeline system in which the main header, the leads and the outer runs were all of the same size—a system nobody would consider using, of course. When the well is developed, the result is substantially the same as the standard methods of using bigger and bigger diameter pipes as the main header is approached. Thus

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TOM'S COLUMN

Dear Fellows:

I'm still kind of hot under th' collar. I bawled out one of our drillers fer doin' somethin' that always gets my goat—bein' careless with th' tool an' casin' joints. I reckon some o' th' boys thinks I'm kind of an ol' fogey or a nervous Nellie; but I guess we all pick up some things that get t' be our pet peeves as we go 'long in life, an' this happens to be one o' mine. You fellers who've spent a lot o' years 'round th' business end of a drillin' rig know what I mean when I say there's a lot o' "don'ts" you learn th' hard way, an' it burns you up t' see somebody goin' right ahead an' doin' th' don'ts.

That's been on my mind; so I jest reckoned I might as well get th' whole danged thing out o' my system here an' now. Joints are a sight more than jest a mess o' wrinkles that keep some hunks o' steel together. They kin go a long way towards makin' your drillin' a steady progress or a lot o' trouble. Don't make much difference what kind o' drillin' you're doin', either. When I first started out, my rig was a pile o' junk I called a "hydraulic" outfit. (Took a lot o' nerve to call it anythin' but a fugitive from th' scrap pile.) Later on I hung on a jettin' pump an' reversed th' process. With a mixture of a lot more muscle an' patience than I got now, I put down a good many wells with th' thing—an' I learned some o' my best lessons at th' same time. One o' them lessons was jest what I started out to talk about—joints. I left some drillin' rods down in th' hole a couple times before I got onto th' fact that th' trouble was more liable to be with me than with th' mill that made th' drill rods. Same thing with th' first rig I owned that wasn't purty much a home-made affair. It was a combination that we called a rock drill an' a "whirler." It was kind of a marriage between a cam an' treadle free-drop cable drill an' a boring outfit with jetting pumps. It wasn't too happy a marriage. But I was always glad I owned that outfit because I got a lot o' good experience that helped in later years—an' part o' that experience was with joints, on th' cable tools an' on th' drill pipe.

Doggone it, here I am wanderin' all over th' back pasture again. Now, to get back to where I started out, I drove up to th' job we was puttin' down fer the' county poor farm. Swig was runnin' the job but he had took off fer two weeks. He brought his wife home

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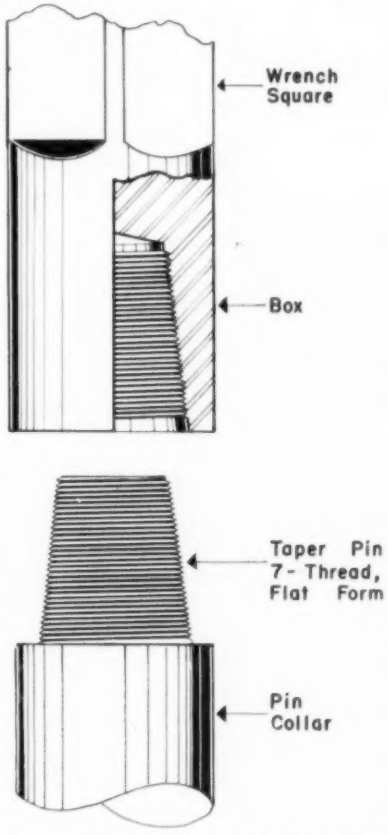
from th' hospital with th' newest addition to their family—a pair o' twins—an' then he was makin' some changes she wanted 'round th' house. That boy is sure gettin' himself quite a family. Seems t' me he's got 'bout as many kids as Heinz has got pickles. Which ain't got much t' do with this subject except that it left this job in th' hands o' this new driller. They was drivin' th' pipe, and it was hard drivin', too. They was puttin' on a half length fer th' final run. When I seen th' way they cleaned them joints (or didn't clean 'em) I blew m' stack. It looked like th' kind of a job my little gran'daughter does when she "helps" her maw with th' dustin'—just a swipe here an' a miss there.

Oh, I'll have to admit that if you stood off a mite they looked O.K. Th' boys took a few quick licks with th' wire brush an' wiped 'em with a piece o' burlap. Maybe we're too fussy, but our rule is that th' joints don't go together until they're as clean as a hound's tooth. You can put your cash on it that there's a lot more trouble that come from pipe joints that ain't made up right than fer any other reason, an' a good bit o' that goes fer tool joints, too.

It didn't help m' disposition any when I came 'round to th' job another time an' seen th' way they throwed them tools together when they changed tools. They had cut th' cable an' put on th' new socket an' was jest makin' up their last joint when I come along an' stuck in my nose. They took off th' protectors an' swung th' joint in place with a clang—quick but careless. Then they took it up without even a look-see. No inspection at all. Didn't look to see if some grit might have got in—or if some moisture had set up rust—or if there was a nick or some other hurt from handlin'—or any sign o' trouble showin' up like a crack startin' in th' collar or th' pin or th' square. It never pays to run a tool into th' hole that shows th' least sign o'trouble, an' th' most important time t' look fer it is when you first set it up.

Another thing. They laid onto that joint like they wanted to murder it. Sure, you want to pull 'em up tight; but you kin overdo it an' hurt th' joint, too.

An' as fer th' joints bein' clean you can't be too fussy. These boys jest haven't learned that lesson yet. They're first-class lads with lots o' git an' go but with a streak o' carelessness that seems to be hard t' get out o' their systems. There ain't any business I know of that makes you pay a higher price fer bein' careless than th' drillin' business.



Standard API joint for cable tools. Proportions here are for taper pin with 2¾" small end and 3¾" large end, normally used for 6" tools.

When it comes to th' tool joints, you're dealin' with th' things that you've got t' trust out o' your sight most of th' time, an' you've got t' keep a close tab on 'em when you've got 'em where you can see 'em. It goes farther than that, too. All our tools has what we call "matched" joints. Here's what I mean.

Tool joints are made to fit some sort o' standard. There's a lot o' different ones but nowadays most of 'em use th' API standards, fer' taper pin joints. It gives you a heavy base on th' pin an' a thick body at th' butt of its box with a quick make-up. As I see it, th' real perfect joint is th' one that has th' threads fittin' deep into each other an' jest pullin' up tight at th' very same time as th' pin an' box shoulders are buttin' up against each other tight. When you get that combination you've jest 'bout got a solid hunk o' steel right there. Now, in actual fact you ain't got much chance to get what you can call a really perfect joint—but you can come doggone close to it if you're careful. That's why they use them "tolerances" fer joints, they've got to allow some leeway fer th' shop that makes th' joints. That's only good sense. But th' way we look at it, you've got to go this thing one step better. While th' leeway they give is purty close, ev'ry once in a while you'll find one joint don't fit jest right on another tool, when both of 'em are probably O.K. as far as th' gauges are concerned. That is, chances are they're both inside th' limits; but may be th' box is on th' small side o' th' limit an' th' pin is on th' big side, an' you've got a joint that takes up too quick. Or maybe th' other way 'round. There ain't much choice. They ain't proper joints t' run either way. If we get a new tool that don't fit in th' string jest th' way we want it to, we have th' pin *or* box or both chased over; an' whenever th' regular wear an' tear on old tools begins to show up, we do th' joints over right away. Sure, we spend more money in th' machine shop; but we think we save a lot more on th' job. An' I'll bet there's a lot o' you fellers—maybe most o' you—who do th' same thing. But there's a lot that don't, too, an' I think it's more important than a lot of 'em realize.

Now, my complaint comes in right here. Why in blazes be so careful 'bout makin' pipe an' tool joints so good an' then let dirt or rust or grease or careless handling spoil th' hull thing when you put 'em together. A little surface rust on tool joints does more to hurt than a person would think to look

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at it. A few tiny kernels o' grit or some hardened grease can do th' same thing. A nick or a hairline crack is where a real break starts. Here's one place where it pays off in th' long run to be a crank.

An' this brings up th' tail end o' my rambling 'round. Fer many years we used drive clamps on th' square of our tools to do all our pipe drivin' an' we used a pullin' ring an' wedges with jacks to pull back. When th' pullin' back was tough we'd use th' drillin' tools with a bumper to jar. We quit this a long time ago, an' now we use bumper weights an' bars entirely fer two reasons—first, we think they do a better job, and, second, there was too much wear an' tear on our drillin' tools the ol' way. I'm interested to know what the drillers think 'bout this business o' drivin' an' pullin' pipe. Sometimes it kin be quite a problem an' bring up some good headaches. How 'bout droppin' a line to th' Journal tellin' your slant on it? I've passed along th' suggestion that they ought to print some different ideas in an article one o' these times. If you've got some ideas on th' subject, won't you pass 'em along?

Good luck an' a good season to you.

Yer ol' friend,
TOM.

A 15-inch Johnson Stainless Steel Screen being installed by N. A. Cook Co. of Langhorne, Pa., in a well for Fairless Hills, housing development near new Fairless Works of U. S. Steel Corp.

THE LEGAL STATUS OF WATER

Illinois

By way of addition to, and correction of, the article on this subject appearing in the last issue of the **Journal,** attention is called to a law passed by the Illinois Legislature in 1951 which is now in effect.

It is titled "An Act to Provide for the Establishment of Water Authorities and to Define Their Powers and Duties."

It is permissive in nature, taking the position that control of ground water is a local responsibility to be carried out by local agencies.

By petition of 500 or more legal voters in any area of the state, submitted to the county court, a hearing will be set by the county judge, following which the court may enter an order determining the boundaries of the "authority" (as the area involved is designated) and providing for submission of the establishment of such authority to the voters of the area in an election. If the election results in a majority favoring the establishment of such an authority, the county judge will enter an order establishing it.

Such authority shall be governed by a board of trustees, appointed by the court, and have the power to:

1. Inspect wells and require information regarding them.
2. Require registration of wells.
3. Require permits for additional wells, or for increasing well capacities.
4. Require plugging of abandoned wells.
5. Regulate the use of water during emergencies, within certain limits.
6. Provide for supplementary sources of water supply.
7. Levy taxes and issue bonds within prescribed limits, to provide money needed for its purposes.
8. To consult with and receive information from the State Water Survey, Geological Survey, etc.
9. Take court action to prevent violations.

Users of water at the time an authority is established cannot be

required to reduce the amount used by them. Provisions of the act do not apply to water used for farm irrigation, small domestic requirements, etc.

High Plains Area of Texas

Permits for drilling irrigation wells are now required, since February 1 of this year, in thirteen counties of northern Texas known as the High Plains area. These counties comprise the High Plains Underground Water Conservation District No. 1. This district was formed by the people of the area and it is financed by their taxes.

One unusual feature of the organization of the District is the setting up of county committees to review and approve applications for permits to drill new wells. The well owner presents his application for a permit to his local committee. If three committeemen approve the plan for the well and its location, the farmer gets his permit. If the local committee feels that the well location proposed by the farmer may adversely affect nearby wells already operating, the committee is supposed to block off areas of the owner's land where new wells may **not** be drilled due to nearness to existing wells. The farmer may then get a permit to drill a well at any other point on his land.

Each county committee is to decide what spacing of wells is best for its county. Different spacing may be adopted for different parts of a county if the amount of water apparently available is greater in one part of a county than in another.

If the farmer is not satisfied with the local committee's decision he can appeal to the board of directors of the District. Also, if the local committee refuses to consider an application, the owner can go directly to the District board.

The purposes of setting up this water district are to protect the water rights of those who already have operating wells and to prevent, if possible, over-development of available ground water in each local area as well as in the entire High Plains region. The overall aim is the conservation of ground water in the sense of taking steps within the limits of authority given to the District to make the best use of the available ground water supplies.

BETTER WELL DEVELOPMENT

(Continued from Page 7)

the speed or velocity at which the water travels is more nearly the same at all points. A number of benefits arise from this, but the most important is the ability of the system to deliver more water because less of the head or pressure is lost in overcoming friction. In a well it means more water with a given drawdown or an equal amount of water with less drawdown than could be obtained without development.

The oldest method of attempting to reduce this loss of head or pressure due to friction is to sink wells of very large diameter, thus actually removing the surrounding formation for a considerable radius around the center of the well. The shortcomings of this kind of construction are so well known that it is rarely considered and does not need to be discussed here.

Another method is to insert coarser sand or gravel around the screen surface, producing what is commonly known as a "gravel-pack." This establishes a coarser envelope around the well screen somewhat similar to that produced by development. The chief difference between the two types of envelopes produced by these methods is that the envelope produced by artificial packing consists essentially of only one step—from the natural formation to the gravel pack—while the one produced by development is a gradual change. The former is somewhat like a single large header with small runs leading from it; and the latter is like a system with many steps from the main pipe to the final runs.

In the naturally-developed gravel envelope there is no abrupt change in particle size, but a series of changes which is gradual. The resulting arrangement of particles is highly stable. Once stabilized by development, no more sand moves into the well.

Records show that proper selection of screen opening sizes with good methods of development produces a well which, in the great majority of cases, gives the best combination of yield, drawdown and permanence for the lowest original and maintenance costs.

Two centrifugal pumps delivering 2,500 gpm from a 110-ft. well drilled for Sprague Electric Co., by R. E. Chapman Co., Oakdale, Mass. Drawdown on this test was 6¼ ft., static level 3 ft.

To produce such a well requires much more in a well screen than just a tubular body with lots of openings of the right size. It requires, first of all, an opening which will permit large amounts of fine or coarse sand, as the case may be, to pass without clogging. This means the opening must be of such shape that any particle passing its outer edge will freely move all the way into the well. The extent to which the screen opening meets this requirement will determine largely the effectiveness of the whole process of development. In the second place, the screen must have as much open area and as little blank area as possible, and yet be strong enough to stand up under vigorous development. The need for a high proportion of open area is not only to furnish plenty of passageway for the water but to reduce what may be called the "blanking" effect on the formation. This means that the less the area of blank screen surface, the greater will be the assurance of developing all portions of the formation around the screen.

Mrs. Kangas: "It was a storm like this when you declared your love for me."

Arvid: "Yes, that was a terrible night."

ASSOCIATION NEWS

This section is devoted to the exclusive use of water well drillers' associations, both state and local. Notices, announcements, changes of officers and other items should be sent to The Editor, Johnson National Drillers' Journal, 2304 Long Ave., St. Paul 14, Minnesota.

INDIANA MEETING

The 23d annual meeting of the Indiana Well Drilling Contractors Association will be held on Thursday and Friday, May 7 and 8, 1953, as previously announced.

The place, however, will be moved to the north wing of the Agricultural Building, State Fair Grounds, instead of the Conservation Building. The new location will provide an even larger exhibit hall, and all the other facilities and arrangements will remain unchanged.

Suitable entertainment and a program of interest to all drillers is being worked out for this meeting. Mr. H. K. Carr, Greentown, Indiana, is Secretary of the Association. He will be glad to furnish details to those interested in attending the meeting.

* * *

IOWA MEETING

The 24th annual convention of the Iowa Well Drillers Association was held at the Hotel Fort Des Moines in Des Moines, February 25 and 26, 1953. The meetings were well attended, and a record number of people registered for the convention. The complete registration was 156, of which 87 were contractors and drillers with their wives. There were 51 representatives of 28 jobbers and manufacturers, with a number of interesting and informative displays.

The officers elected for the coming year are: Frank McCutcheon, President, Des Moines; W. H. White, Vice-President, Alburnett; Travis Parker, Secretary-Treasurer, West Branch; S. R. Ames, C. Bonnickson, and C. L. Jennings were elected Directors of the organization.

The technical sessions included talks of the Pleistocene deposits in Iowa; lead-zinc possibilities in Iowa; the geology of Iowa; the relation between engineers and contractors; use of well screens and gravel packing in sand wells; and cost accounting for the small contractor.

A special program was arranged for the ladies, which coincided with the technical session and the business meeting. The annual banquet climaxed the convention, followed by an evening of dancing.

W. P. Steele sent this picture of well drilling in Eastern Tanganyika, Africa. Crew is bailing sand from a 6-inch well, 114-feet deep.

* * *

COLORADO MEETING

The Colorado Water Well Contractors' Association held its 19th annual convention at the Shirley Savoy Hotel in Denver, November 7 and 8. The following officers were elected for 1953: B. L. Holden, Hudson, Pres.; Burton Payne, Byers, V. Pres.; G. C. Koogle, Denver, Treas.; T. P. Ahrens, Denver, Sec.; and W. N. Tapp, Denver, Ass't Sec.

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IDAHO MEETING

The annual convention of the Idaho Well Drillers Association will be held July 10 and 11 at Sun Valley. Further details will be announced at a later date.

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PENNSYLVANIA MEETING

The annual joint meeting of both the Eastern and Western Divisions of the Pennsylvania Water Well Contractors Association will take place on Friday and Saturday, April 10 and 11, 1953. The meeting place will be the Hotel Gettysburg, Gettysburg, Pa. There will be space for both indoor and outdoor displays.

Two well-known speakers have been selected, and included in the program will be technical sessions, a banquet, and an interesting program for the ladies present.

MISSOURI MEETING

The Missouri Association will hold its 17th annual meeting at the Colonial Hotel in Springfield, Missouri, April 13 and 14, 1953.

Space for displays of equipment and literature is ample and in keeping with the custom of past years; no charge will be made for display space. It will be "first come first served." Exhibits may be set up on Sunday, April 12.

The program as arranged provides for two technical sessions, the usual business meeting and annual banquet and entertainment on Monday evening, April 13. A large attendance is anticipated for this meeting. Mr. Dale L. Fuller, Service Secretary, P. O. Box 250, Rolla, Missouri, will be glad to supply additional information.

NEBRASKA MEETING

The 22nd Annual Conference and Short Course of the Nebraska Well Drillers Association was held

E. O. Longstreet, Matheson, Ontario, drilled this 6-inch test well, 102-feet deep, equipped with 6 feet of Johnson Screen. The well yields 147 gpm at 12 feet drawdown.

Nebraska drillers and others who attended the 22nd Annual Conference of the Nebraska Well Drillers Assocation at the University of Nebraska, February, 1953.

in Lincoln on February 19 and 20, at Bancroft School Building, University of Nebraska. One hundred and twenty-five drillers braved bad weather and threatening blizzard conditions to attend this meeting. Seventy representatives of forty-seven manufacturing and jobbing firms were represented. Thirty of these firms had exhibits on display.

The technical session covered legal aspects of drilling; a discussion of submersible pumps; and a progress report on the U. S. Geological Survey's test drilling program. Dr. G. E. Condra, of the Conservation & Survey Division, introduced the main speaker at the banquet—the governor of the State of Nebraska, Robert E. Crosby.

An important action taken at the meeting was the adoption of a code of ethics which included the following points:

Promote conservation of water resources of Nebraska.

Engage in fair trade practices.

Place welfare of the customer first.

Co-operate with each other by exchanging information and by mutual assistance.

Foster a better understanding of the laws and the need for sanitary well location and construction.

Conduct operations with full understanding of the important responsibilities of the well drilling trade.

Business sessions were held in the afternoons of both days of the meeting. The following officers were re-elected to serve during 1953: Fred D. Salmon, Concord, Pres.; Erlo Cox, North Loup, V. Pres.; Andrew Olson, Oakland, Treas.; and V. H. Dreeszen, Lincoln, Sec'y.

* * *

MICHIGAN MEETING

An outstanding convention is assured on May 26, 27 and 28, when the Michigan Well Drillers Association holds its 25th "Silver Anniversary" Convention at the U. S. Armory Building, North Mechanic St., in Jackson, Mich. Harold Armstrong of Battle Creek, convention chairman, promises unusually interesting programs and demonstrations.

The Armory is 50 x 175 feet, so there will be ample room for all. Convention headquarters will be at the Hotel Hayes.

* * *

NORTH DAKOTA MEETING

At the 37th meeting of the North Dakota Well Drillers Association, held at the Gardner Hotel in Fargo, Fred J. Simpson of Bisbee was elected president. Other officers for 1953 are John Bakken of Wahpeton, Vice Pres., and Fred J. Sletvold of Oakes, Sec'y-Treas.

Directors of the organization, elected at the meeting, are Carl W. Olson of Edgely; K. J. Thompson of Dunn Center; and Paul Jaszkowiak of Bismarck. R. C. Adair is publicity chairman.

MINNESOTA MEETING

On March 26, 27 and 28, the 31st Annual Convention of the Minnesota Water Well Contractors' Association took place at the Hotel Nicollet in Minneapolis. There was a good turnout of both water well contractors and exhibitors, plus an interesting schedule of technical subjects and entertainment.

The technical subjects covered were: power plants; standard regulations for water wells for all the Northwestern states; manufacturing and use of water well drilling lines; and wire rope uses and abuses.

On March 27, a Ladies' Day program included a trip through the University of Minnesota, the State Capitol, and the State Historical Society. Water well contractors, drillers and their wives were the guests of the manufacturers and jobbers at the Grand Banquet and the subsequent entertainment.

At the business session on March 28, John Hoge of St. Paul was re-elected President for the coming year, Tom Renner of Minneapolis was elected Vice-President, and Al Zuercher of St. Paul was re-elected Secretary. Norm Ovrom continues as Executive Secretary.

FOR YOUR CONVENIENCE, Edward E. Johnson, Inc. has printed a code book for ordering Johnson Well Screens by telegram. This allows almost any screen to be ordered in a minimum-rate telegram. This useful and convenient booklet will be sent to you on request.

ADVERTISEMENTS

We will insert advertisements for drilling equipment wanted or for sale, help or work wanted, etc., for our readers, free of charge. Advertisements must be brief, and we cannot assume responsibility for them, but will be glad to put parties in touch with each other by this means and suggest that they investigate any offers or inquiries carefully for themselves.

FOR SALE: Sullivan No. 37 drill mounted on 1941 Ford 1½-ton truck, Gardner-Denver 4x5 duplex mud pump; completely equipped, ready to drill, with 100 feet of N rods; drill complete overhauled; truck has new exchange motor. For quick sale $4500.00 cash F.O.B. my shop. Write: J. L. Havlick, 2703 N. Pittsburg Street, Spokane, Washington.

FOR SALE: I.C.K. Model Waukesha Engine with twin disk clutch 13 H.P. at 1800 RPM. Has done 4-inch and 6-inch work. Overhauled recently. Starts good. Price $150.00. Write: E. E. Cribley and Son, 7105 Dexter-Ann Arbor Road, Dexter, Michigan.

FOR SALE: Failing H.D. 1500, complete tools, etc. also 1000 Failing and 1000′ capacity Sullivan. Write: Fred E. Butler, Box 1832, Casper, Wyoming.

FOR SALE: #16 Ideco trailer mounted; complete with catheads and casing reel, also #71 Speed Star; mounted on 1940 Ford truck; both of these rigs are A-1 throughout and ready to go to work. Write: T. W. Van Winkle & Son, Salem, Iowa.

WANTED: Driller and tool dresser, also man to operate well boring machine, plenty of work. Write: T. W. Van Winkle & Son, Salem, Iowa.

WANTED: Three drillers for one year in Turkey and Angola, capable teaching local drillers, $600.00 month and expenses. Write: World Mining Consultants, 220 Broadway, New York 38, N. Y.

FOR SALE: Failing 1500′ capacity drill, also Sullivan and Franks 1000, all complete, tools, drill rod, etc. Write: Fred E. Butler, Box 1832, Casper, Wyoming.

WANTED TO BUY: Mayhew Model 1000 rotary drill 1946 or newer, must be in excellent condition, either with or without water truck, drill stem, bits and water well equipment. State cash price and condition of all equipment in first letter. Write: Western Drilling Company, Medicine Lake, Montana.

WANTED: Star 71 Spudder, Bucyrus-Erie No. 24L or 44 oilfield cyclone drilling machine with or without tools or some machine that will drill 2,000 ft. deep, mounted or dismounted. State price and condition. Write: Louis A. Bradfield, Box 25, LeRoy, Ohio.

FOR SALE: Lincoln 200 amp-welder with 2 cycl. Wisconsin air cooled engine; used 10 hours only; with 100 ft. of cable-holder, hood and box ⅛″ rod. Complete cash $400.00; also #25 Armstrong drill rig on hard rubber for towing, no derrick, nor engine, counter shaft on back ready for engine mounting, will spool 2500 ft. of ¾″ line and sand line-Bucyrus drill line spooling device. Cash $400.00. Write: Gray Well Drilling Company, P. O. Box 181, Delafield, Wisconsin.

FOR SALE: One 16″ practically new spiral bit with wing guide. Write or phone: Thein Well Company, Clara City, Minnesota.

FOR SALE: Complete well drilling equipment with drill pipe, etc. Mounted on new trailer with an all new LeRoi motor. Write: Mrs. Bertha Connor, Box 400, Artesian, South Dakota.

FOR SALE: No. 10 Ideco mounted on trailer, 33 ft. telescoping derrick with pipe braces and power derrick hoist machine equipped with blower, cathead, 500 ft. ⅝″ line, 500 ft. ⅜″ line. In first-class condition. Price complete $1,500.00. Write: Henry Schuster, Box 104, Golden, Illinois, or telephone 97.

FOR SALE: Gus Pech all-steel boring machine; 32′ mast mounted on International truck, complete with rods, 6″ to 24″ augers; reasonably priced. Write: Milaeger Well Drilling Company, 4630 West Burleigh Street, Milwaukee, Wisconsin.

FOR SALE: Failing rotary drill on new International, 600′ rod, new hoses, reconditioned 4½x5 GD pump, automatic chucks, spider, new King swivel, and all necessary equipment. Other type of work forces sale of this drilling rig. Write or phone 3221, Dakota Drilling, Hettinger, North Dakota.

FOR SALE: Two all steel drilling rigs, mounted on truck; pipe 2″, 5″, 6″ galvanized 6⅝″ black; two 10-foot 10-inch well screens No. 60 slot, also drilling tools. Write: Clarence Chadwick, Box 14, Deford, Michigan.

WANTED: 28-L fully equipped rig. State age, condition, and price; also complete casing reel for 22-W, 1950 Model. Write: Mr. A. Rankin, Hanley, Saskatchewan, Canada.

WANTED: A Bucyrus-Erie 24-L or similar type steel rig. Write: Fred Garrett, 2605 Avenue K, Lubbock, Texas, telephone 2-8458.

WANTED: Experienced drillers, cable tools; must be able to weld; have opening for two or three men; good pay and steady work. Write: William A. Crislip, 5434 Redwood Hiway North, Santa Rosa, California.

FOR SALE OR TRADE: 1000′ rotary, 4½ x 5 pump, 3″ Kelly, new King swivel, 450′ 2⅞″ drill pipe and miscellaneous tools bits, etc. Mounted on 1942 Ford truck with new motor; $3,500 or trade for 22-W or equal. Write: William A. Crislip, 5434 Redwood Hiway North, Santa Rosa, California.

FOR SALE: Armstrong Model 35W Band wheel type all steel drill, semi-trailer mounted; 36-ft. mast rubber shock absorber, all in good working order; extra shafts and gears; extra motor; ten tires alone on this outfit worth $400.00. Real bargain, $1,000 cash. Write: Stephen Kopyar, R.D. #4, Binghamton, New York, phone Binghamton 4-0747.

WANTED: Rotary drilling rig for test drilling 4½-inch hole to about 300 feet. Write: T. R. Hanks, Springfield Road, Decatur, Illinois.

Rig used by Voorhees near Vernal, Utah, to drill irrigation well 3000 ft. deep, completed in sandstone. Yield, 300 gpm; drawdown 100 feet.

(Continued from Page 14)

TOOLS FOR SALE: Two 12", two 14", two 16", one 10" bits; three pairs of jars; one 12" Star perforator; one pair of 10" elevators; 10" & 12" drilling scows, 3 stems; 2¼"x3¼" O.W.S. & 2x3 A.P.I. joints; blower for Star, Keystone, & Bucyrus-Erie; one turbine test pump, 6-8" bowls; 150 ft. 5" column; belt head or electric drive; after March 1 will have 6" to 12" casing for sale; will buy drilling equipment. Write: Gerald E. Foster, 827 Broadway, Sonoma, Calif.

WANTED TO BUY: All steel well boring machine that will dig 3 ft. holes or larger; machine must be in good condition; not over three or four years old. Write Daniel Bugbee, Box 10, Finley, North Dakota.

WANTED TO BUY: One well drill 24-W or 71 or 72 Speed Star; must be in good shape, truck mounted preferred and priced right. Write: Dee K. Linn, East Station, Box 308, Hooks, Texas.

FOR SALE: No. 240 Speed Star spudder, two years old, good condition and operating every day. Mounted on K-5 International 1½-ton truck. Truck in first-clas condition, good tires, go anywhere. Price $2850.00. No tools. Write: George I. Warner, P. O. Box 104, McBean, Georgia.

FOR SALE: Pump business, also well drilling rig and shop tools. If interested, contact: S. J. Davis, 1009 West Fir, Portales, New Mexico.

FOR SALE: Bucyrus-Erie 21-W rig equipped with 6-inch tools and lines; mounted on a 1½-ton Dodge truck. Write: Edward Sanders, 226 Nelson Avenue, Saratoga Springs, New York.

WANTED: Used 1000-foot rotary Mayhew or Franks truck mounted drill rig; also mud pump, Gardner-Denver, or Wheatly 5x6 or 4x5. Write: E. R. Hanson & Sons, Wahoo, Nebraska.

FOR SALE: Two all steel drilling rigs, mounted on truck; pipe 2", 5", 6" galvanized 6⅝" black; two 10 foot 10-inch well screens No. 60 slot, also drilling tools. Write: Clarence Chadwick, Box 14, Deford, Michigan.

FOR SALE: One 5"rotary table, one 2½" bushing for 5" table, one 15XV King swivel, this equipment is brand new, will sell same for one-half price or $503.00. Write: D. E. Edwards, Inc., West Branch, Iowa.

FOR SALE: Drill tools complete string of 3" tools for 4" work; 6" bailer, fishing tools, rope sockets. Write: George Hutchinson, R. 2, Wadsworth, Ohio.

FOR SALE: 1951, 22W drilling machine, with tools and cable; mounted on 1½ ton White truck. Price $7,500.00. Write: L. J. Kessler, Troy, Missouri, phone 349J.

FOR SALE: Rotary drilling rig, in good condition, price $2,500.00. Write: Watts & Vestal Drilling Company, Farwell, Texas.

FOR SALE: One Deming figure 4700 deep-well turbine pump, serial No. 14417, consisting of the following: One 8" 7-stage bowl assembly; ten 10-foot sections of 6" x 1¼" sleeve-coupled column; one 5" strainer; one SD88 - 16½ disch. head fitted with Johnson HP 30, 1:1 ratio gear head; one 36" flexible shaft with flanges. Capacity 500 g.p.m. at 125' TDH: One Ford industrial power unit, Model #120, complete with safety shutdown device. Good as new, purchased last year, operated about ten hours. Immediate delivery, $2,500.00, f.o.b., Cranbury, New Jersey. Write: Lewis W. Barton Company, Kresson Road, Haddonfield, New Jersey. Phone: Haddonfield 9-6500.

FOR SALE: One 33W Bucyrus-Erie, mounted on a 1½ ton Chevrolet truck; this machine is completely re-conditioned, has new four cylinder LeRoi motor. This drill is in excellent condition will sell with or without drilling tools and cable. Write: D. E. Edwards, Inc., West Branch, Iowa.

FOR SALE: Drilling business. Howell jetting drilling rig mounted on 1940 3-ton International K-5 truck in good working order, with 400 ft. 2-inch drill rods; 400 ft. 1-inch rods, lots of tools. Work to start on; all modern 6-room house with a little over one acre of ground; good territory to work in. Write: A. F. Boettcher, Fonda, Iowa.

FOR SALE: Well drilling rig used for prospecting; recently rebuilt throughout of White Oak timbers, steel cable rigging, complete with new string of 2¼-3¼" tools. International power unit, trailer mounted; drill used one year after over-hauling; $1200.00 with prospecting accessories; World War II Veteran finishing college. Write: A. D. Williams, 206 S. Chestnut St., Platteville, Wisconsin.

FOR SALE: Rebuilt Keystone rig, located Washington County, Oklahoma; trailer mounted, truck and tools; 700-ft. capacity; Hercules engine, $1800.00; working on well. Write: Box Mil, c/o Edward E. Johnson, Inc., 2304 Long Avenue, St. Paul 14, Minnesota.

FOR SALE: Two all steel drilling rigs, 22-W Bucyrus Erie mounted on good International truck, 36-foot derrick, 35 h.p. Hercules engine, electric starter, calf reel; level wind 500 ft. ⅝ in. drilling cable; 50 ft. ⅜ in. sand line. No tools; price $5000.00; also Ideco No. 16 mounted on 1947 Chevrolet truck, extra good; 36-foot telescope derrick rubber shock in head, 36 h.p. red seal Continental motor; electric starters in front and rear of rig; electric hoist to raise and lower derrick; calf reel; 500 ft. ⅝ in. drilling cable; 500 ft. ⅜ in. sand line; double crank on walking beam; rigs are in A-1 shape, ready to go to work. No tools. Write: Guy Beemer, Lakota, Iowa.

—o—

Mother: "Now, Junior, be a good boy and say 'Ah-h' so the doctor can get his finger out of your mouth."

SUBMERSIBLE PUMP

Sta-Rite Products, Inc., of Delavan, Wis., have announced a new submiersible pump. This pump is adaptable to wells of 4" diameter and larger and is particularly suited to wells of extreme depths. One of the more important features of the submersible pump is the easy installation, requiring no bulky above-ground mechanism, and the consequent elimination of the danger of freezing and flooding. The Sta-Rite submersible features a stainless steel casing on the pump and motor; stainless steel shaft; bronze impellers that are matched and locked to operate as one continuous rotating element.

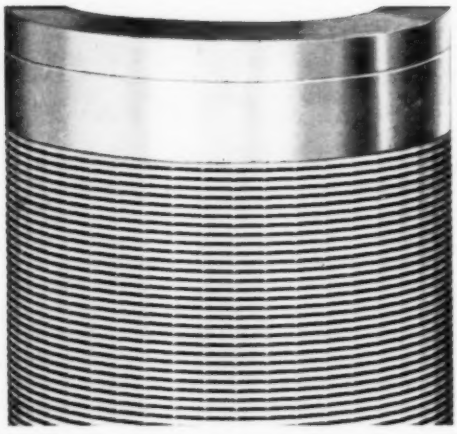
Further data may be obtained from Sta-Rite Products, Inc., Delavan, Wisconsin.

The little girl was showing her playmate her new home.

"This is my daddy's den. Does your daddy have a den?"

Neighbor Girl: "No, he just growls all over the house."

WHY?



Why is it that Johnson Well Screens feature a continuous slot, instead of the perforations, punch holes, or louvers found in other well screens?

Common sense gives us the answer — OPEN AREA!

It is only through open area that water can flow from the formation into the well, so it naturally follows that the more open area a screen has, the more water it will transmit. Whether your water-bearing formation is 6 feet or 60 feet thick, a Johnson Screen will transmit 3 times as much water per foot of screen than will a perforated screen.

Doesn't a screen like this deserve a trial?

Based on the same size openings,
JOHNSON WELDED WELL SCREENS
exceed all other well screens
in strength and capacity.

EDWARD E. JOHNSON, Inc.

— World's Oldest Exclusive Manufacturer of Well Screens —

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